Darwin, J2EE, and Mars

Business–Oriented Session — Industry Case Study
(Advanced Level)

Abstract (maximum 350 words, currently 267)

NASA's two robotic Mars Exploration Rovers (MER) will roam over the red planet's surface, conduct experiments, and download data to Earth ground stations. The stations will relay the MER data to the Jet Propulsion Laboratory (JPL), which will store the data and make it accessible to NASA scientists and researchers worldwide via the Web–based Collaborative Information Portal (CIP).

This session will be about Darwin, the Java–based software that implements CIP. Developed at the NASA Ames Research Center, Darwin satisfies several orthogonal requirements, and its architecture overcomes some major technical problems. We'll discuss some of the design lessons we learned, and our thoughts on future directions for Darwin.

CIP includes highly responsive applications that allow its users to view, analyze, and interact with the diverse MER data in a variety of graphical and tabular formats. These applications run on the Windows, Linux, Solaris, and Macintosh platforms. During the mission, users who are interested in certain events can subscribe to be notified whenever the events occur.

Darwin uses Java applets and Swing to create interactive browser–based client applications. In order for its middleware infrastructure to be scalable, modular, robust, maintainable, and reusable — and provide good turnaround times for the applications — we developed it with J2EE technologies, including Enterprise JavaBeans (EJB) and the Java Message Service (JMS). We successfully interfaced the applets, which must download quickly, to the heavyweight EJB and JMS objects. Darwin allows multiple researchers to access large amounts of experimental data simultaneously without overloading the middleware. The Darwin system is a seamless integration of in–house software, commercial software, open source software, and shareware.

Outline (maximum 500 words, currently 154)

1. A brief overview of NASA's Mars Exploration Rovers 2003 project
   a. Its scientific rationale
   b. Joint collaborative effort
   c. Some pictures of the rovers
2. The role of the Collaborative Information Portal (CIP)
3. The high–level architecture of the Darwin software, which implements CIP
   a. From wind tunnels to Mars — a brief history of Darwin at NASA Ames
   b. Client applications, middleware, and backend
4. Darwin client applications
   a. Why did we use applets?
   b. Brief overviews and screenshots of the applets
5. The Darwin RMI server

a. Why is this necessary?
        b. Thin clients vs. thick clients
6. Middleware services
        a. Architectural overview
        b. Query session bean caching
        c. Multithreaded data fetching
        d. Use of the Java Message Service (JMS)
        e. Integrating the WebLogic application server and the Jetspeed portal server
7. Backend
        a. Integrating the Oracle and MySQL databases
        b. Data loaders
8. Lessons learned and future directions for Darwin

Biographies (maximum 100 words each, currently 48, 56, and 81)

Joan Walton is the project manager for Darwin at the NASA Ames Research Center. She was one of Darwin's first designers and developers, and she led its evolution from supporting wind tunnel testing with Perl and CGI to implementing the Collaborative Information Portal with Java applets and J2EE.

Leslie Keely is a computer scientist at the NASA Ames Research Center. She led Darwin's client applications development team, and she designed and implemented the Data Navigator application. During the past 13 years, she has been a software developer in visualization, data analysis, and distributed applications, and she has programmed in Java for over three years.

Ronald Mak is a senior scientist at the Research Institute for Advanced Computer Science located at the NASA Ames Research Center, where he designed and led the development of the Darwin middleware. He is currently investigating future technologies for Darwin. He has programmed professionally for over 25 years and was one of the early adopters of Java. Ron is the author of the book *Java Number Cruncher: The Java Programmer's Guide to Numerical Computing* which was recently published by Prentice–Hall.